

REMARKS

This paper is responsive to a Non-Final Office action dated May 7, 2007. Claims 1, 3, 7-26, 28-37 and 55-60 were examined. Claims 55-58 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 4,603,291 to Nelson (hereinafter, "Nelson"). Claims 1, 3, 10-12, 16-22, 26-30, and 59-60 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,666,046 to Mietus (hereinafter, "Mietus") in combination with Nelson. Claims 7-9, 13-15, and 23-25 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Mietus in combination with Nelson.

Claim Rejections Under 35 U.S.C. § 102

Claims 55-58 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 4,603,291 to Nelson (hereinafter, "Nelson"). Claim 55 is amended to clarify the invention. Regarding amended claim 55, Applicants respectfully maintain that Nelson, alone or in combination with other references of record, fails to teach or suggest that

a voltage difference between base-emitter voltages of the first and second bipolar transistors is formed across the resistor, the resistor being coupled to the base of the first bipolar transistor, and current through the resistor being substantially equal to the base current of the first bipolar transistor,

as required by amended claim 55. Nelson teaches that

[a]s shown in FIG. 3, the correction circuit 30 which generates the TlnT correction term uses only four transistors, Q<sub>41</sub> through Q<sub>44</sub>. This simple circuit can be easily inserted into a bandgap reference by applying the correction output current I<sub>o</sub> to the appropriate node of the bandgap reference circuit. As shown, current generators 41 and 42 are used, respectively, to generate an IPTAT current I<sub>41</sub> and a non-IPTAT current, that is, a current with substantially zero temperature coefficient, I<sub>42</sub>. The form of the output current I<sub>o</sub> is determined by the currents associated with the transistors Q<sub>41</sub> and Q<sub>42</sub>, that is, by the ratio of currents I<sub>41</sub> and I<sub>42</sub> and by the ratio, A, of the emitter junction areas of Q41 and Q42.

Col. 5, lines 26-39. The base current of transistor Q<sub>41</sub> is based on a current through resistor 41 and the emitter current of transistor Q43. The base current of transistor Q<sub>42</sub> is based on the emitter current of transistor Q44 and the current through resistor 41. In contrast, amended claim 55 requires that the current through the resistor be substantially equal to the base current of the first bipolar transistor. Since Nelson fails to teach or suggest every limitation of amended claim 55 and no other reference of record provides the missing disclosure, Applicants respectfully request that the rejection of claim 55 and all claims dependent thereon, be withdrawn.

Rejections of Claims 1, 3, 10-12, 16-22, 26-30, and 59-60 Under 35 U.S.C. § 103

Claims 1, 3, 10-12, 16-22, and 59-60 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U. S. Patent No. 5,666,046 to Mietus (hereinafter, “Mietus”) in combination with Nelson. Claim 1 is amended to clarify the invention. Regarding amended claim 1, Applicants respectfully maintain that Mietus, alone or in combination with Nelson or other references of record, fails to teach or suggest

a current mirror circuit configured to mirror a first current at least partially based on the amplified base current and configured to provide the mirrored current to a voltage reference node, the base current being proportional to a voltage difference between two base-emitter voltages of bipolar transistors configured to have different current densities, the voltage difference being formed across the resistor coupled to the base and the base current being at least partially based on a resistance of the resistor coupled to the base,

as required by amended claim 1. Mietus teaches that a base of bipolar transistor 34 is coupled to power supply electrode 37, which operates at a power supply voltage of V<sub>SS</sub> (e.g., ground potential). Col. 3, lines 20-23. Resistors 46 and 43 of Mietus are also coupled to the power supply voltage of V<sub>SS</sub>. (Fig. 2). However, nowhere does Mietus teach or suggest that the base current of bipolar transistor 34 is at least partially based on a resistance of either resistor 46 or

resistor 43. Rather, the base current of bipolar transistor 34 of Mietus is related to the emitter current  $I_1$ , which is inversely proportional to the resistance of resistor 36. Fig. 1; col. 5, lines 1-25. Resistor 36 of Mietus is coupled to the emitter of bipolar transistor 34, not the base of a bipolar transistor, as required by claim 1.

Nelson fails to compensate for the shortcomings of Mietus. Applicants respectfully maintain that Nelson fails to teach or suggest a current mirror circuit configured to mirror a first current at least partially based on the amplified base current and configured to provide the mirrored current to a voltage reference node, the base current being proportional to a voltage difference between two base-emitter voltages of bipolar transistors configured to have different current densities, the voltage difference being formed across the resistor coupled to the base and the base current being at least partially based on a resistance of the resistor coupled to the base, as required by amended claim 1.

Since Mietus fails to disclose or suggest the recited limitation and no other art of record adds the missing disclosure, accordingly, Applicants respectfully request that the rejection of claim 1 and all claims dependent thereon, be withdrawn.

Regarding claim 3, Applicants respectfully maintain that Mietus, alone or in combination with Nelson, fails to teach or suggest that

a reference voltage produced by the voltage reference generator is proportional to a parabolic function of temperature,

as required by claim 3. The Office action apparently admits that Mietus fails to teach the limitations of claim 3 and relies on Nelson to supply this teaching. Nelson teaches a bandgap reference circuit 10 that provides a bandgap voltage reference satisfying the following relationship:

$$V_{OUT} = C_1 \frac{KT}{q} + V_{go} \left( 1 - \frac{T}{T_o} \right) + VB_{eo} \left( \frac{T}{T_o} \right) + \frac{KT}{q} \ln \frac{I_c}{I_{co}} + \frac{nKT}{q} \ln \left( \frac{T}{T_o} \right).$$

Fig. 1; col. 2, lines 26-68. This relationship fails to teach a reference voltage proportional to a parabolic function of temperature, as required by claim 3. Nelson also teaches a parabolic correction circuit to correct for a TlnT nonlinearity term of a bandgap voltage reference. Fig. 2; col. 3, lines 21-41. The correction circuit of Nelson generates a current proportional to  $T^2$  (i.e., IPTAT<sup>2</sup>). The IPTAT<sup>2</sup> current of Nelson corrects for a TlnT nonlinearity term of a sensor circuit. Col. 3, lines 21-68. Nowhere does Nelson teach or suggest that a reference voltage produced by a voltage reference generator is proportional to a parabolic function of temperature, as required by claim 3. Since Mietus fails to teach or suggest the recited limitation and no other art of record adds the missing disclosure, accordingly, Applicants respectfully request that the rejection of claim 3 and all claims dependent thereon, be withdrawn.

Claim 26 is amended to clarify the invention. Applicants respectfully maintain that Mietus, alone or in combination with Nelson or other references of record, fails to teach or suggest

a base current proportional to a voltage difference between a base-emitter voltage of a second bipolar transistor and a base-emitter voltage of the first bipolar transistor, the voltage difference being formed across a first resistor coupled to a base of the first bipolar transistor, the base current being at least partially based on a resistance of the first resistor; mirroring a first current at least partially based on the amplified base current; and generating a reference voltage at least partially based on the mirrored current,

as required by amended claim 26. Mietus teaches that a base of bipolar transistor 34 is coupled to power supply electrode 37, which operates at a power supply voltage of V<sub>SS</sub> (e.g., ground potential). Col. 3, lines 20-23. Resistors 46 and 43 of Mietus are also coupled to the power supply voltage of V<sub>SS</sub>. (Fig. 2). However, nowhere does Mietus teach or suggest that the base current of bipolar transistor 34 is at least partially based on a resistance of either resistor 46 or resistor 43. Rather, the base current of bipolar transistor 34 of Mietus is related to the emitter

current  $I_1$ , which is inversely proportional to the resistance of resistor 36. Fig. 1; col. 5, lines 1-25. Resistor 36 of Mietus is coupled to the emitter of bipolar transistor 34, not the base of a bipolar transistor, as required by claim 26.

Nelson fails to compensate for the shortcomings of Mietus. Applicants respectfully maintain that Nelson fails to teach or suggest a base current proportional to a voltage difference between a base-emitter voltage of a second bipolar transistor and a base-emitter voltage of the first bipolar transistor, the voltage difference being formed across a first resistor coupled to a base of the first bipolar transistor, the base current being at least partially based on a resistance of the first resistor; and mirroring a first current at least partially based on the amplified base current; and generating a reference voltage at least partially based on the mirrored current, as required by amended claim 26.

Since Mietus fails to disclose or suggest the recited limitation and no other art of record adds the missing disclosure, accordingly, Applicants respectfully request that the rejection of claim 26 and all claims dependent thereon, be withdrawn.

Regarding claim 28, Applicants respectfully maintain that Mietus, alone or in combination with Nelson, fails to teach or suggest that

a reference voltage produced by the voltage reference generator is proportional to a parabolic function of temperature,

as required by claim 28. The Office action apparently admits that Mietus fails to teach the limitations of claim 28 and relies on Nelson to supply this teaching. Nelson teaches a bandgap reference circuit 10 that provides a bandgap voltage reference satisfying the following relationship:

$$V_{OUT} = C_1 \frac{KT}{q} + V_{go} \left( 1 - \frac{T}{T_o} \right) + VB_{eo} \left( \frac{T}{T_o} \right) + \frac{KT}{q} \ln \frac{I_c}{I_{co}} + \frac{nKT}{q} \ln \left( \frac{T}{T_o} \right).$$

Fig. 1; col. 2, lines 26-68. This relationship fails to teach a reference voltage proportional to a parabolic function of temperature, as required by claim 28. Nelson also teaches a parabolic

correction circuit to correct for a TlnT nonlinearity term of a bandgap voltage reference. Fig. 2; col. 3, lines 21-41. The correction circuit of Nelson generates a current proportional to  $T^2$  (i.e., IPTAT $^2$ ). The IPTAT $^2$  current of Nelson corrects for a TlnT nonlinearity term of a sensor circuit. Col. 3, lines 21-68. Nowhere does Nelson teach or suggest that a reference voltage produced by a voltage reference generator is proportional to a parabolic function of temperature, as required by claim 28. Since Mietus fails to disclose or suggest the recited limitation and no other art of record adds the missing disclosure, accordingly, Applicants respectfully request that the rejection of claim 28 and all claims dependent thereon, be withdrawn.

Regarding claim 59, the Office fails to point out where Mietus and/or Nelson teach or suggest

a base-collector voltage of the first bipolar transistor equals a voltage difference between two base-emitter voltages biased at different current densities,

as required by claim 59. Applicants respectfully maintain that Mietus, alone or in combination with other references of record, fails to teach or suggest the limitations of claim 59. Accordingly, Applicants respectfully request that the rejection of claim 59 and all claims dependent thereon, be withdrawn.

*Rejections of Claims 7-9, 13-15, and 23-25 Under 35 U.S.C. § 103*

Claims 7-9, 13-15, and 23-25 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Mietus in combination with Nelson. Applicants believe that claims 7-9, 13-15, and 23-25 depend from allowable base claims and are allowable for at least this reason. Accordingly, Applicants respectfully request that the rejections of claims 7-9, 13-15, and 23-25, be withdrawn.

*Additional Remarks*

The Detailed Action of the Office action failed to provide a reason for the rejections of claims 31-37. Applicants respectfully maintain that claims 31-37 are allowable over the art of record and request an allowance of those claims.

Claim 3 is amended to be in independent form.

Claim 9 is amended to clarify claim language.

Claims 10 and 20 are amended to be consistent with amended claim 1.

Claim 11 is canceled.

Claim 16 is amended to correct grammar.

Claim 28 is amended to be in independent form.

Claim 31 is amended to be consistent with amended claim 26.

Withdrawn claims 38-54 are canceled.

New claims 61-66 are added. Applicants believe that new claims 61-66 depend from allowable base claims and are allowable for at least this reason.

In summary, all claims are believed to be allowable over the art of record, and a Notice of Allowance to that effect is respectfully solicited. Nonetheless, if any issues remain that could be more efficiently handled by telephone, the Examiner is requested to call the undersigned at the number listed below.

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Nicole Teitler Cave

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Respectfully submitted,



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